WHAT EVERY BODY IS SAYING: THE LINK BETWEEN PHYSIOLOGICAL AROUSAL AND THE USE OF EMBODIED LANGUAGE IN THE NARRATION OF ANGRY MEMORIES

by

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ABSTRACT

In recent years, the idea that a bidirectional relation exists between physiological and psychological processes has become widely accepted. The current data show that emotions are inextricably linked to the body, and that an inherent part of having an emotional experience is having a physiological reaction. From the perspective of the embodied cognition literature the subsequent recall of an event entails at least a partial reconstruction of the sensory experience that occurred at the time of the original experience. Given this, it seems intuitively reasonable that people's narratives about emotional experiences should reflect people's physical experiences through the use of embodied language. In this study (n = 49) I examined three questions: 1) when, how, and to what extent is the body represented in narratives about everyday emotional experiences? 2) Is arousal, both self-reported and physiologically measured, when initially recalling an emotional memory associated with aspects of how the body is represented in a narrative about that memory? And, 3) does the use of embodied language in a narrative about an emotional memory change physiological responding to that memory after narration? In considering these questions I found that while the vast majority of people use embodied language when narrating about a past emotional event, both the amount and type of embodied language used varied dependent upon gender, self-reported levels of arousal and autonomic nervous system arousal. Specifically, the pattern of embodied narration appears to take two distinct pathways. For women a nice adaptive

pattern emerges of higher levels of self-reported anger leading to more embodied language use, which leads to lower self-reported and sympathetic nervous system arousal. For men, this pattern was not clear, indicating that relation between embodied language use and gender is more complex than originally thought.

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INTRODUCTION

People talk about the distressing events in their lives. They share their sad moments, their disappointments, the frustrating and the infuriating in an effort to make sense of them, to find meaning in them, and to grow from them. In spite of all that we have learned about narrative construction over the past 2 decades, specifically about the social, emotional, and cognitive processes surrounding it, to date, the study of storytelling remains notably disembodied. That is, considering that every experience about which we would construct a narrative happens to our physical bodies, and that an inherent part of having an emotional experience is having a physiological reaction, to our knowledge, little to no systematic work has been done to investigate how people represent their bodies in autobiographical narratives, and what the implications for doing so may be.

Both literal and metaphorical representations of the body are omnipresent in literature, across a wide range of writing, from children's fiction to adult autobiography. Consider this passage from the popular children's book *When Sophie Gets Angry, Really, Really Angry*: "When Sophie gets angry, really, really angry…She kicks. She screams. She wants to smash the world to smithereens. She roars a red, red roar, and Sophie is a volcano, ready to explode" (Bang, 2004, p. 16).

Or this passage from the notable neo-Freudian psychoanalyst Karen Horney (1966) written to convey her feelings of anger and confusion, in her book *New Ways in Psychoanalysis:*

> Everything in me is storming and surging and pressing for light that will resolve the confusion. I seem to myself like a skipper who leaps from his safe ship into the sea, who clings to a timber and lets himself be driven by the sea's tumult, now, here, now there. He doesn't know where he is going. (p. 232)

As demonstrated by the examples above, both young children and adults rely on embodied language and physical metaphor to both understand and communicate their emotional experience. In the children's book, the author links Sophie's internal emotional experience to Sophie's externalized behavior in a very simple way, using the physical metaphor of a volcano to describe the internal experience of anger. On a much more sophisticated level, Horney uses the same techniques to represent her feelings of anger. Such linguistic representations of embodied experience, defined throughout this paper as language that conveys subjective and psychological experience using words and phrases that are based on physical, tangible action and experience, are omnipresent in fiction and literature and help to make the details of the story vivid for the reader. Throughout the remainder of this article, I will refer to these features of narratives with the term "embodied language."

In spite of the prevalence of embodied language in autobiography and literature, from a scientific point of view, we still have really basic questions to answer about when, where, and how embodied language is used in everyday narratives. While the embodied cognition literature is investigating the link between physical experience, cognition, and behavior in a number of other domains, including language processing, to our knowledge, there have been few investigations about the relation between physiological experience and narration, and none concerning the use of embodied language in autobiographical narratives. Thus, in this study, designed to be a preliminary investigation into this topic, I ask three basic questions: 1) When, how, and to what extent is the body represented in

narratives about everyday angry experiences? 2) Is arousal, either self-reported or physiologically measured, when remembering an emotional memory associated with the use of embodied language during narration of that memory? And, 3) Does the use of embodied language in narrating that memory change physiological responding at re-exposure to that memory?

When, How, and to What Extent Is the Body Represented in Narratives About Angry Memories?

Narratives are defined as goal structured accounts of past events (Bruner, 1991) that range from brief anecdotes (Bamberg, 2006) to fully developed autobiographies (McAdams, 2001, 2008; Singer & Bluck, 2001). As individuals construct narratives about the events in their lives they interpret and evaluate the storied events, assign intention to the actors, delineate the physical and psychological consequences to themselves and others, and make meaning of what happened. In so doing, the narratives that people construct become much more than factual descriptions of events; they have the potential to become the building blocks for identity development (McAdams & McLean, 2013; McLean et al., 2010; Pasupathi & Hoyt, 2009), perspective taking (Dunn et al., 1987; Fivush, 1991), meaning-making (Conway & Singer, 2004; McLean, 2005), and emotion regulation (Pasupathi, 2003; Pasupathi et al., in press; Thompson et al., 1993).

While the extant literature does a good job of detailing the varied ways people construct narratives and the effects such narratives have on psychological outcomes (e.g., increased well-being, the ability to make meaning of an experience, to bring about a sense of resolution, etc.) researchers have had little to say regarding how a person's

physical experience at exposure to a memory may impact the features of the narrative about that memory. In other words, the majority of the narrative work to-date focuses on the narrator's psychological experience rather than their physical experience. For example, when narrative researchers talk about a story being "resolved," they mean that the event is resolved *psychologically* for the narrator, not necessarily resolved in the physical, tangible world.

It is important to note that in saying that the embodied aspect of narrative has not been studied I do not mean to imply that embodiment does not manifest in the literature. To the contrary, examples of embodied language in narratives are easy to find both within and outside of the psychological literature, as I consider in the next section. However, embodied language has yet to be examined as a unique and potentially important aspect of autobiographical narratives. In what follows, I consider the way that people's physical experience may be represented in narratives based on an examination of narratives from a broad sample of readings.

Embodied Action Language

Perhaps the most common way that the body appears in narrative is through descriptions of the body's capabilities and actions, what I will call throughout the rest of this article, *embodied action*. While seeming like a necessarily inherent piece of a narrative, essential in order to tell a story, the implications of how the body's actions are represented in a narrative may be as psychologically relevant as they are practical. For example, consider the following narrative from Olivia: "I run. I know that my body is strong and I know that I put a lot of work into keeping it healthy. And so, I'm definitely a lot more confident and proud, I guess, now" (Busanich, 2012, p. 312). To Olivia, what

she does with her body (run) helps to shape her identity and impacts how she feels about herself (confident and proud).

Ballerina Gelsey Kirkland demonstrates the same phenomenon in her book, *Dancing on My Grave*, when she writes about what it is like for a dancer to recover from a debilitating injury. "You can come back and feel quite uncoordinated, like a stranger in your own body if you haven't danced for a while" (Kirkland, 1980, p. 312). Again, what the body can do, or in this case can't do, shapes the narrator's identity and impacts how she feels about herself.

A slightly more subtle way of portraying embodied action in narrative is through the conveyance of specific, sensory details. Sensory details include sight, sound, touch, smell, and taste imply action on the part of the body and serve to envelope both the writer and the listener in the narrator's experience. In this passage, Louie Zamarini describes what he experienced after his aircraft was shot down in the Pacific during World War II:

> I found the raft offered an unlikely intellectual refuge. I had never recognized how noisy the civilized world was. Here, drifting in almost total silence, with no scents other than the singed odor of the raft, no flavors on my tongue, nothing moving but the slow procession of shark fins, every vista empty save water and sky, my time unvaried and unbroken, my mind was freed of an encumbrance that civilization had imposed on it. In my head, I could roam anywhere, and I found that my mind was quick and clear, my imagination unfettered and supple. I could stay with a thought for hours, turning it about. (Hillenbrand, 2010, p. 113)

Another way that embodied language appears in people's narratives is as a messenger or purveyor of emotion. Emotions consist of three critical components: physiological arousal (autonomic responses), subjective emotional experience, and expressive behavior (e.g., facial expressions) (Fridja, 1993). Current emotion theories purport that knowledge about one's emotional state comes in part from the awareness and interpretation of physiological arousal (Damasio, 2000; Kever et al., 2015; Niedenthal &

Maringer, 2009). From this perspective, it is in experiencing my heart begin to race, my mouth becoming dry, my skin turning pale and my gut contracting, that would allow me to ascertain that, “I am afraid.” In other words, in some cases, the experience of emotion is bottom-up and it is our physical experiences that serve to inform our psychological states. Consider this description of anger written by a 14-year-old female: "I get this bubble of rage. I go wild. I feel like crying cause I don’t know how to control myself. It happens too quickly. I am angry" (Personal letter).

In this narrative, it is the girl’s physical experience that both prompts her realization of and drives her psychological experience of anger. Therefore, for this story to make any sense to a listener, and in order for it to be able to adequately convey the narrator’s invisible psychological experience, it must be grounded within a realm shared by both the speaker and the listener: the world of physical experiences.

In other narratives, the body is used to communicate information not to the narrator, but to others. This is exemplified in the following narrative written by Sandra, a young woman suffering from anorexia nervosa: “It (my weight) was my body’s way to tell others that I had a problem, a mental problem. That you don’t feel good about yourself” (Nordbø et al., 2006, p. 13)

Both of these narratives illustrate the central role the body plays in the communication of emotion to the self and to others. Thus, given the importance of linguistic representations of embodied experience to the process of accurately and vividly portraying emotional experiences, I will examine the presence of physical descriptions of felt emotion as an important communicator of embodied state.

Each of the aforementioned narratives illustrates that without the inclusion of

embodied action language narratives would seem incoherent and incomplete (Linde, 1993; Reese et al., 2011). Coherence then demonstrates one way in which embodied language is already implicitly captured in research on narrative (Linde, 1993; Reese et al., 2011). This is important as coherence is both socially demanded (Linde, 1993) and linked to well-being (Baerger, 1999; Waters & Fivush, 2015). The use of embodied action in a narrative also contributes to its overall elaborateness, another feature that has also been related to meaningful psychological outcomes (Adler et al., 2015; Pals, 2006; Pennebaker, 2009).

Though inclusions of embodied action are fundamental to a complete narrative, it is clear that people vary in the extent to which they focus on the embodied aspects versus the psychological aspects of experience more emphasized by traditional narrative approaches (Pasupathi et al., 2014). Consider the following narrative expressing the writer's grief:

> When I was 17, my dog was ill…I had to be the one to take her to put her to sleep. At first I stayed strong, but after we arrived at the vet my heart sank and the tears started to flow. At this point I couldn't hold back the sobs and struggled for the next while to keep my composure. (narrative collected in our lab)

The preceding story is filled with embodied language as the narrator strives to communicate his cognitive, physical, and emotional experience to the reader. Contrast this with another narrative collected about grief: "My friend killed himself and it made me feel really sad. I also felt a little guilty. As any friend would because we all think we could have prevented it. It was the worst time of my life. Every time I think about it makes me sad" (Data collected in lab).

While the emotional experience of grief is the same in both narratives, the level of embodied language use is significantly different. Specifically, in the second narrative,

there is no evidence of embodied language use on the part of the narrator, and this may have important implications for psychological processes down the road.

In all of the aforementioned narratives (those about running, dancing, feeling, etc.), it is the writers' descriptions of their embodied action that lay the foundation for the more psychologically oriented work typically studied in the narrative literature (e.g., exploration, meaning making, identity formation, growth, etc.). In other words, it is only after the preliminary descriptions of the body and its' physical states are described does the narrator delve into the deeper, psychologically oriented work of narrative. Given this I believe that descriptions of embodied action may play an important role in building a foundation for a coherent, meaning-laden, growth-inducing narrative.

Physical Metaphor

Physical metaphor is another way that people may linguistically represent embodied experience. Conceptual metaphor theory (CMT) describes the way that individuals make sense of abstract concepts, including emotions, by grounding them in patterns of bodily actions and manipulations of tangible objects (Gibbs et al., 2006; Lakoff & Johnson, 2008). From this perspective, people use physical metaphor to both describe and to understand difficult-to-explain emotions or experiences. Consider the popular colloquialism, *heart broken*. This is the word that Ron used to describe himself after the death of his daughter Mary:

> I am heartbroken. There is always this…sort of an underlying gnawing sensation, you know. You feel it in your heart, I think. And that maybe there is a heaviness of heart. I sigh that, I don't know, is very sad that the death happened. I think that I will always carry it with me…It is like a physical presence of a weight bearing on in my body… (Gudmundsdottir, 2009, p. 6)

The physical metaphors used in this paragraph (e.g., heart being broken, a gnawing sensation, carrying a burden, the presence of a weight) combine to describe the elusive, inexplicable experience of losing a child into a cohesive, contained scenario that most readers, though having not lost a child themselves, can relate to. Importantly, it is the claim of conceptual metaphor theory (CMT) that the ability of the reader to make sense of these metaphors resides in the readers' automatic construction of a mental simulation whereby we imagine performing the bodily actions referred to in the excerpt. Thus, metaphorical references to "carrying a burden" are understood by the reader's mentally simulating what it must be like to carry a heavy weight (Gibbs Jr., 2013; Lakoff & Johnson, 2008).

This same linguistic strategy of grounding an elusive, hard to explain psychological concept in everyday physical reality, is used in the following excerpt by a boxer as he tries to communicate his passion for his sport:

> The boxer willfully perseveres in this potentially self-destructive trade because, in a very real sense, he is inhabited by the game that he inhabits . . . a veteran middleweight who has rumbled on three continents for over a decade . . . [commented], 'you can't (give it up) it's in your blood so much . . . you can't give it up'. (Wacquant, 2005, p. 88)

The physical metaphors used in this paragraph (e.g., boxing being in your blood; inhabiting the sport of boxing) describe the experience of being passionate about a sport in a way that most readers, even if not enthralled with boxing themselves, can understand (Gibbs Jr., 2013; Lakoff & Johnson, 2008).

In sum, embodied action language and physical metaphor are widely evident in narratives about personal experience in both research and popular press contexts, and are likely related to elaboration and coherence – concepts narrative researchers have studied

previously. However, embodied language has not been quantified and examined in its own right. The first goal of the present study then was to develop a reliable way of quantifying embodied action language and physical metaphor, and to examine the prevalence of such language in narratives about everyday emotional experience.

Assuming that people will use embodied language and that the prevalence of embodied language use will vary across people, as do other more widely studied narrative variables (e.g., meaning making, coherence, elaboration), our second question addresses a potential reason for that variance, one that is tied directly to the body and its physical experience. Specifically, I ask the question, is arousal when initially recalling an emotional memory associated with embodied language when narrating that memory?

Is Arousal When Initially Recalling an Emotional Memory Associated With Embodied Language When Narrating That Memory? Is This Relationship Moderated by Gender?

Self-Report Ratings of Arousal

From the discrete emotions perspective, emotions consist of both subjective ratings and objective physiological components (e.g., Frijda & Levenson, 1988). Given this, we measured both of these parts of the emotional experience and included them in this study: the subjective components via self-report ratings of anger, with higher anger indicating higher subjective arousal, during each epoch, and the physiological components via measures of autonomic nervous system arousal (respiratory sinus arrhythmia (RSA) and skin conductance levels (SCL). I examined each unique component and their associations with the use of embodied language separately.

Given that the self-report ratings of arousal and the physiological ratings of arousal do not always move together, I believe that including both reports of arousal is

important in the context of this study because people's interpretations of physiological arousal have been shown to vary (Levenson, Carstensen, & Gross, 1994). In other words, while an increase in heart rate may be highly distressing to one individual, necessitating the use of a myriad of coping skills, another individual may be relatively undisturbed, or even unaware, of the same increase in heart rate. By looking at the relation between both components of a discrete emotion and its relation with the use of embodied language, I believe that I will gain a broader perspective on representations of the body in narrative.

Physiological Measures of Arousal

The relation between autonomic nervous system (ANS) arousal and emotion has been widely studied (see Levinson, 2014 for a review). A key premise of functionalist theories of emotion is that emotions organize the activity of the ANS and other physiological systems and have noticeable effects on bodily states (e.g., Bradley et al., 2001; Levenson, 1992). From this point of view, emotional experiences are partially encoded in our physiological responses to an experience and simply thinking about an event invokes the partial reproduction of the autonomic arousal states that occurred during the actual event (Barsalou, 1999; Barsalou et al., 2008). Some important implications of this for the present study are that (1) emotions are embodied in the form of measureable physiological arousal; and (2) far from being incidental, arousal affects and shapes information processing, which could be reflected in narratives (Winkielman et al., 2015). In this study, I am asking whether or not the physiological states that occur when initially recalling an emotional event are related to representations of embodied experience in participants' narratives about that emotional experience.

Recalling and Narrating About Emotional Memories

Physiological Arousal and Language Processing

A robust body of past work has demonstrated that physical experience and physiological arousal play a causal role in the conceptual and emotional understanding of language (Niedenthal et al., 2005; Niedenthal & Maringer, 2009; Winkielman et al., 2015). Indeed the evidence supports a relationship between physical states and multiple linguistic processes such as lexical access (Borghi et al., 2004), syntactic analysis (Chambers et al., 2004) and sentence comprehension (Glenberg & Kaschak, 2002). For example, a smiling participant is quicker to identify a smiling face and pull a lever towards them (an approach movement) than a frowning participant (e.g., Frijda, 1986; Lang, 1995), and the facial muscles used in smiling (zygomaticus major and orbicularis oculi) are more active during the reading of happy sentences than sad sentences (Glenberg, 2009). These data suggest that embodied action and physiological arousal go hand in hand with the processing and understanding of emotion and language. By extension, I believe that embodied action and physiological arousal could also relate to language production in narrating emotional experience.

Sato, Schafer, and Bergen (2007) took an initial step toward demonstrating the effect of embodied action on the use of language. In their study, they relied on the common conceptual metaphors of happiness being a thing to search for (e.g., he was on the path to happiness) and joy being a container (e.g., his joy was overflowing). Experimenters approached individuals in public places (i.e., a grocery store, the library, restaurants) who were either searching for something or drinking something. Once identified, participants were asked to describe a person in an emotionally ambiguous

picture as either "searching for happiness" or being "filled with joy." A main effect of participants' embodied action immediately prior to their choice showed that participants who were engaged in searching behavior used the happiness metaphor 54% more often than the joy metaphor ($p < .001$, two-tailed Fisher's exact test). This study supports the idea that there will be a relationship between physiology and narration such that higher physiological arousal might correspond to subsequently using more embodied language to narrate an event.

Other work linking narrative and physiology has been conducted within the field of expressive writing. This literature demonstrates that when individuals talk or write about emotional events, important biological changes occur (Pennebaker, 1989). For example, multiple studies indicate that talking about trauma in the laboratory results in changes in participants' blood pressure, heart rate variability, muscle tension, and skin conductance both during and immediately after disclosure; specifically, people show decreased levels of arousal across all of these measures. People manifest lower blood pressure (McGuire, 2005), lower respiration and heart rates (Pennebaker, Hughes, & O'Heeeron, 1987) and lower levels of skin conductance after writing (Francis & Pennebaker, 2002). These results have been duplicated across the spectrum of negative emotions, from physical pain, to grief, to rage. From this wide range of possible negative emotions that have been shown to exert an influence over a person's physiological functioning, I chose to examine anger in this study.

The Emotion of Anger

I made the decision to focus this study on a single emotion, the emotion of anger, in light of the fact that many researchers have provided empirical evidence for distinct

physiological signatures for specific emotions (see Kreibig, 2010 for a review). Given that anger may be one of the most physiologically investigated emotions as well as one of the most commonly felt (Berkowitz & Harmon-Jones, 2004), focusing this study on anger ensured generalizability across the sample with regards to affective states and provided a well-established baseline pattern of physiological responding in anger-eliciting contexts, which typically results in decreased RSA (Overbeak et al., 2012), and increases in SCL (Fredrickson & Levinson, 1998; Levenson, 1990). Further, given that anger is one of the only negative emotions that is also an approach emotion (Carver & Harmon-Jones, 2009), I expected to be able to see activation of both the sympathetic and parasympathetic branches of the autonomic nervous system in participants who were reexperiencing an angry memory.

Physiological Responding to Emotion

The Autonomic Nervous System

The role of the ANS in anger response and anger regulation is divided between two distinct systems: the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). Broadly, the SNS serves as a "gas pedal" and mobilizes the body to respond to challenges. The PNS system acts as a "brake," in reducing heart rate and restoring baseline levels of arousal. With regards to the systems' involvement in responding to anger, I will consider each of these systems individually.

The Sympathetic Nervous System

Another well-studied psychophysiological marker of ANS functioning is electrodermal responses (EDA), composed of tonic levels of skin conductance (skin

conductance level) and phasic skin conductance responses (SCR). In this study I will be looking specifically at SCL rather than SCR in order to capture the average arousal response to an angry memory across a 3-min epoch rather than using tonic SCL upon initial recall (Fowles, 1986, 1993)

Previous studies investigating SCL and anger have demonstrated that exposure to an angry memory amplifies SCL (Denson et al., 2012; Gross, 2002). This is important as it indicates that SCL reactivity has empirically been a good index of how intensely arousing a memory is and often signifies how angered the participant is about that memory (Levenson, 1992, 2014).

The Parasympathetic Nervous System

The study of the PNS and its role in anger regulation has often focused on the measure of respiratory sinus arrhythmia (RSA) as an indicator of the neurophysiological mechanism of cardiac vagal control (De Vries-Bouw et al., 2011; El-Sheikh et al., 2009), and it is posited that baseline RSA may denote both an individual's potential for emotion regulation capacity and trait-like levels of arousability (Beauchaine, 2001; Hastings et al., 2008; Porges, 2007). Given previous studies of RSA and anger, I expect to find a pattern of vagal withdrawal at exposure to an angry memory (Osumi & Ohira, 2009) resulting in increased heart rate and lower levels of RSA. This study examined whether changes in physiological arousal when recalling a memory were related to the embodied language used in subsequently narrating that memory.

Physiological Arousal and the Use of Embodied Language

Given the currently available physiological data we believe that there are two logical hypotheses regarding the relation between physiological arousal and the use of embodied language.

First, it may be possible that increased physiological arousal at exposure to an angry memory may lead to the use of more use of embodied language. Given that people perceive emotion in their bodies (James, 1884) physiological arousal could bring along with it an increased sensitivity to bodily states and actions. From this perspective, I would expect a pattern of decreased SCL and increased vagal withdrawal upon exposure to an angry memory, a highly activated emotion, to lead to an increase in the use of embodied action words. This hypothesis is supported by findings that demonstrate that anger is primarily an approach emotion used to prime an individual for action (Stemmler et al., 2007; Tiedens & Linton, 2001). In other words, when the emotion of anger is present, the brain organizes our physiological resources in such a way as to activate specific physiological adaptations suited to meet the needs of the situation. Thus, when we are angry and therefore likely to be preparing to take physical action, people may experience an increase in SCL, heart rate, and respiration rates, all bodily responses that prepare us to actively engage in confrontation.

Alternatively, I hypothesized that physiological arousal may be associated with the use of less embodied language. This may be because people may opt to use language to direct their attention away from their aroused and uncomfortable physical state in favor of seeking a more comfortable state of homeostasis. Thus, as participants intentionally, or unintentionally ignore their naturally occurring emotions during their narration of an

angry memory, SCL immediately after narration would be expected to be higher than prior to narration (Fowles, 1980). This is in line with the current literature documenting the relation between higher SCL and behavioral inhibition (Pennebaker & Chew, 1985). RSA in this situation would be expected to decrease indicating vagal withdrawal.

Is the Relation Between Arousal at Initial Recall and the Use of Embodied Language Moderated by Gender?

In addition to testing relations between physiological arousal, self-reported anger, and the use of embodied language, I will explore whether these relationships are moderated by gender. There are several reasons to anticipate the possibility of gender differences. First, the extant data indicate that there is a difference between males and females in the degree to which there are physiological changes in response to emotional stimuli; specifically, that women respond more strongly to sad states than men, and that men react more strongly to angry states than women (Maden, 2000; Verona & Curtin, 2006). Given that being in a physiologically aroused state congruent with a presented emotional situation makes it easier to understand language about that situation (Havas et al., 2007), and that emotion states prime preparation for action (Bradley et al., 2001; Levenson, 1992), men, who on average become more physiologically aroused upon elicitation of an angry memory than women, may manifest a stronger relationship between physiological arousal and embodied language within the context of this study, which is focused on anger.

Second, there is some evidence that males and females are different in their relative awareness of physiological arousal (Gross & John, 2003; Pennebaker, 1987). The proposed rationale for these findings is that men and women differ on their levels of

"self-objectification," defined as the tendency to experience one's body principally as an object to be evaluated for its appearance rather than for its effectiveness. Within objectification theory, it has been proposed that self-objectification accounts for poorer interoceptive awareness in women (Ainley & Tsakiris, 2013; Gottman & Levenson, 1988), and leads to women becoming estranged from their bodies and their sexualities (Bartky, 1990; Tolman, 2002).

It is also possible, however, that gender will not moderate the relation between arousal and the use of embodied language as many previous findings within the physiology literature find such gender effects only within the context of complex interpersonal relationships (e.g., Gottman & Levenson, 1988, 1992; Leveson & Carstensen, 1994; marital interaction in Levenson & Gottman, 1985). Thus, participants' interpretation of our study protocol will be an important issue. Participants may interpret our study to be an interpersonal experience or they may not. Although the anger experiences included in this study involved interpersonal anger, the memories were recalled in a solitary situation and participants constructed written, not oral narratives, about them. Given this, participants may respond in accordance with the literature about basic emotional processing, which finds virtually no sex differences (Levenson et al., 1990; Levenson et al., 1991; Levenson, Oyama, & Meek, 1987; Levenson & Ruef, 1992).

Does the Use of Embodied Language in a Narrative About an Emotional Memory Change Self-Reported and Physiological Responding to That Memory Upon Reexposure?

Above, I focused on potential links between physiological arousal when initially recalling a memory, self-reported anger when recalling the memory, and the use of embodied language when narrating about that memory. This is important because using

more or less embodied language when narrating about an emotional autobiographical memory might also influence the extent of physiological arousal when participants are re-exposed to that memory. As stated previously, when individuals are required to narrate about emotional experiences, significant changes appear within the body (Pennebaker & Hughes, 1987; Watson & Pennebaker, 1989). SCL in particular appears to be highly responsive to variations in storytelling. Experiments by Buck (1984) indicate that highly expressive participants, defined as those who wrote with an open acknowledgment of emotion, worked to construct a coherent story, were able to switch perspectives, and who expressed themselves openly and honestly, evidenced lower levels of SCL after narration than did their less-expressive peers. Additionally, in term of physiological arousal levels, expressive individuals appeared to benefit the most from narrating (Pennebaker & Evans, 2014).

This is in line with Fowles' previously mentioned work alluding to SCL as a measure of active inhibition (Fowles, 1980). Specifically, if increased SCL is associated with inhibition, it should follow that when an individual discloses an angry memory with high levels of emotional expressivity, there should be a decrease in SCL, and that those classified as high disclosers, as compared with low disclosers, should evidence the greatest decreases in SCL. In this study, I seek to expand this work by emphasizing a different type of language than has been examined in the past. Specifically, instead of focusing on high levels of emotional expressivity, I will be considering whether those that use relatively more embodied language also show a pattern of lower arousal after narrating, compared to those that use less embodied language. In accordance with previous studies, SCL should be lower at reexposure when participants use more

embodied language during narration, as actively narrating in such a manner suggests that they are inhibiting less than when they use embodied language.

With regards to RSA, our measure of PNS activation, the extant literature demonstrates that cardiovascular changes have been associated with both inhibition processes as well as general somatic and cognitive activity. This means that changes in RSA may be reflective of the cognitive challenge of remembering an emotional event as well as reflective of emotional arousal. Nevertheless, Pennebaker et al. (2007) found that cardiovascular activity was consistently higher when participants talked about an important life event as opposed to a mundane life event, and Bar-Haim and colleagues found that children demonstrated greater vagal suppression in response to an emotional story containing separation-reunion themes than those that did not (Bar-Haim, 2004). These findings hint at interplay between the emotional processing of an autobiographical memory and ANS activity. In other words, they suggest that RSA is indicative of more than just the cognitive challenge of remembering and narrating an event; they suggest that RSA arousal may be an accurate index of emotional arousal. However, none of the previous studies considered embodied language or postnarration responding. Given this, I will look at both embodied language and postnarration responding in terms of RSA in a fully exploratory way.

There is a long history of previous research demonstrating that emotionally unexpressive adults are more physiologically reactive to a variety of emotional stimuli (see Gross, 2002 for a review). In this study, I begin to look at how using embodied language, in addition to the more traditional emotionally expressive language, may also be related to physiological responding. Given previous work in this area, I expect to find

that the use of embodied language in narratives about angry memories to decrease SCL responses. I make no *a priori* hypotheses regarding the directionality of differences in RSA.

Summary

In recent years the idea of an embodied mind has been the catalyst for numerous studies exploring the connection between cognitive processes, physiological responding, and physical behavior. The current study, asks the following three questions: 1) When, how, and to what extent is the body represented in narratives about everyday emotional experiences? 2) Is arousal at the initial recall to an emotional memory associated with aspects of how the body is represented in a narrative about that memory? And, 3) Does the use of embodied language in a narrative about an emotional memory change self-reported and physiological responding to that memory upon reexposure?

METHODS

To address these three questions, I made use of two previously collected data sets and combined participants assigned to the narrative conditions across samples. In the narrate condition, participants were asked to recall a time when "someone did or said something and they ended up feeling angry at that person," were given time to narrate about that event, and then were asked to think about that same event again. Self-report ratings of anger were assessed after each epoch of the study. Physiology data were collected continuously throughout this process (see Figure 1).

Participants

Sample One was a group of 30 emerging adults between the ages of 18 and 28 years who were recruited from the student participant pool and community locations in a Rocky Mountain metropolitan area for a study on "social experiences and physiological responding." The data for 1 participant was excluded due to physiological equipment failure. The final sample included 29 participants (12 males, 17 females, *M* age = 21.6, *SD* age = 3.09). Participants identified as European American (78%), Latino/a (7%), Asian American (7%), and Pacific Islander (7%). Community members were paid $20 for completing the session; students from the participant pool were given the option to be paid at the same rate as community members or to receive course credit. Sample Two was a group of 21 emerging adults between the ages of 18 and 28 years who were recruited from the student participant pool (9 males, 12 females, *M* age = 21.6, *SD* age =

3.09). Participants identified as European American (71%), Asian American (14%), Latino/a (5 %), Native American (5%), and African American (5%).

Measures

The primary measures for the study involved physiological responding across the exposure, regulation, and reexposure epochs of the experiment. Physiological responding was operationalized as electrodermal activity (SCL) and respiratory sinus arrhythmia (RSA). The four physiological variables of interest were measured and standardized scores computed for each participant individually. I chose to standardize scores for individuals rather than across the sample because our hypotheses predicted both increases and decreases in our physiological variables of interest dependent upon gender and epoch. Thus, if I standardized across the sample and if my hypotheses turn out to be correct and I see an increase in one variable for males and a decrease in the same variable for females, the numbers would cancel each other out and result in a z score of 0, thereby negating any gender effects. The same argument applies for expected variation by epoch. In other words, if scores had been standardized across the sample, important information about individual people and their *patterns* of responding could have been lost.

Standardized scores were computed by calculating the standard deviation of each participant's SCL or RSA responding across all epochs (baseline, exposure, and re-exposure). Difference scores between the individual epochs of interest and baseline were then computed and divided by the person's individual standard deviation (e.g., $(SCL_{exposure} - SCL_{baseline})/SD_{SCLacrossallepochs}$). Thus, skin conductance and RSA at exposure reflect the person's individual-level increase or decrease, relative to his or her individual baseline and individualized range.

Skin Conductance Level

SCL was measured and analyzed using standard procedure for the James Long Company (Caroga Lake, NY) equipment and PHY General Physiology Analysis System software. Average SCL across each individual epoch was computed as an index of sympathetic nervous system arousal.

Respiratory Sinus Arrhythmia

RSA was also measured using the James Long Company (Caroga Lake, NY) equipment and PHY General Physiology Analysis System software. Continuous recordings of electrocardiogram (ECG) and respiration were amplified and filtered through a 4-channel bio amplifier, with the ECG channel high pass filter set to .1 Hz and a low pass filter set to 1000 Hz.

Self -Report Measures of Anger

Self-reported emotion ratings were assessed at baseline, exposure, immediately following narration, and following the reexposure epochs of the experiment. Specifically, participants were asked to rate on a scale of 1, which represented "Not at all" to 7, which represented "The most I've ever felt," how angry they were feeling at the present moment. Means and standard deviations by epoch are presented in Table 1.

Embodied Language Coding System

The narratives were coded for the presence of embodied language, specifically embodied action and physical metaphor. Embodied action was defined as something that the narrator did with their body. Examples include, "I ran, I cried, I jumped, I ate." The second category of embodied language was physical metaphor. Physical metaphor was

defined as language that makes sense of abstract concepts, including emotions, by grounding them in patterns of bodily actions and manipulations of tangible objects. Examples include, “I was heartbroken,” “I had butterflies in my stomach,” and “I was lighter than air,” See Table 2 for examples and full descriptions of each code. Each instance of embodied language was flagged and one point assigned to the narrative. Thus, if a narrative read, “I went to the library and read a book,” it would have received a score of “2” because the narrator described doing two things with their body. The primary investigator coded all the narratives in Study 1 and then randomly selected 30% of the narratives to be coded by a trained research assistant who was blind to the hypotheses of the study in order to establish reliability of the coding systems. The coding system for presence of embodied language was deemed reliable with a 99% agreement rate between first author and the research assistant, ($\kappa = .96$), indicating that both coders found the same instances of embodied language use in the narratives 99% of the time. Thus, out of 367 instances of embodied language used, the coders agreed on 363 of them.

Four narrative variables were then derived from these codes. First, I computed an “Overall Embodied Language” score. For this variable, all instances of embodied language use were summed, divided by total word count in order to control for length of the narrative, and then multiplied by 100 to yield more easily conceptualized numbers. Because physical metaphor is well investigated and written about in the embodied cognition literature we decided to look at it separately as well as part of the broader category of embodied language. Thus, we computed an “Overall Physical Metaphor” variable by summing the total number of physical metaphors coded in a narrative and dividing by word count, then multiplying by 100. The variable “Embodied Action

Focused Language" was created to represent the percentage of total embodied language use that consisted of embodied action language. Thus, the total number of embodied action codes were summed and divided by the sum of all embodied language references. The fourth narrative variable, "Physical Metaphor Focused Language" was created to represent the percentage of total embodied language use that was comprised of physical metaphor. Thus, the total number of physical metaphors were summed and divided by the sum of all embodied language references.

Procedure

Participants were asked to refrain from consuming alcoholic or caffeinated beverages and from smoking cigarettes for 2 hours prior to the experiment. On arrival, after consent procedures, participants washed their hands using Ivory soap and were hooked up to the physiological recording equipment.

Once hooked up to the physiological recording equipment, participants rated emotionally neutral landscape photos during a 3-min vanilla baseline task. They then completed a 4-min paced breathing baseline task. After obtaining our baseline data, participants were exposed (initial exposure) to the angry stimuli. After a 1-min rest period, participants were asked to regulate their anger by writing a narrative about that stimulus (regulate), and after another 1-min rest period they were reexposed (immediate reexposure) to the memory (see Figure 1).

Initial Exposure

For the autobiographical memory stimulus, participants were asked to "remember a recent, specific time in your own life when you felt very angry about something." The

prompt continued with the instructions, “Now I want you to spend a few minutes remembering the event in detail. Just concentrate on reliving the event in your mind. Go back to the moment when you felt the most angry and stay there.”

Regulation Condition

During the regulate epoch, participants were told to “Write about your own experience that you just recalled. Write about what happened, how you felt about it, and what it meant to you.”

Reexposure

After narrating, reexposure to memory was prompted as follows, “Now think again about that specific time when you felt angry. Spend some time remembering the event in detail. Just concentrate on reliving the event in your mind. Go back to the moment when you felt the most angry and stay there.”

Conclusion of Study

After the reexposure epoch, participants were unhooked from the SCL and RSA equipment. Participants reported how long ago this angry memory had occurred. They were then compensated for their participation and dismissed.

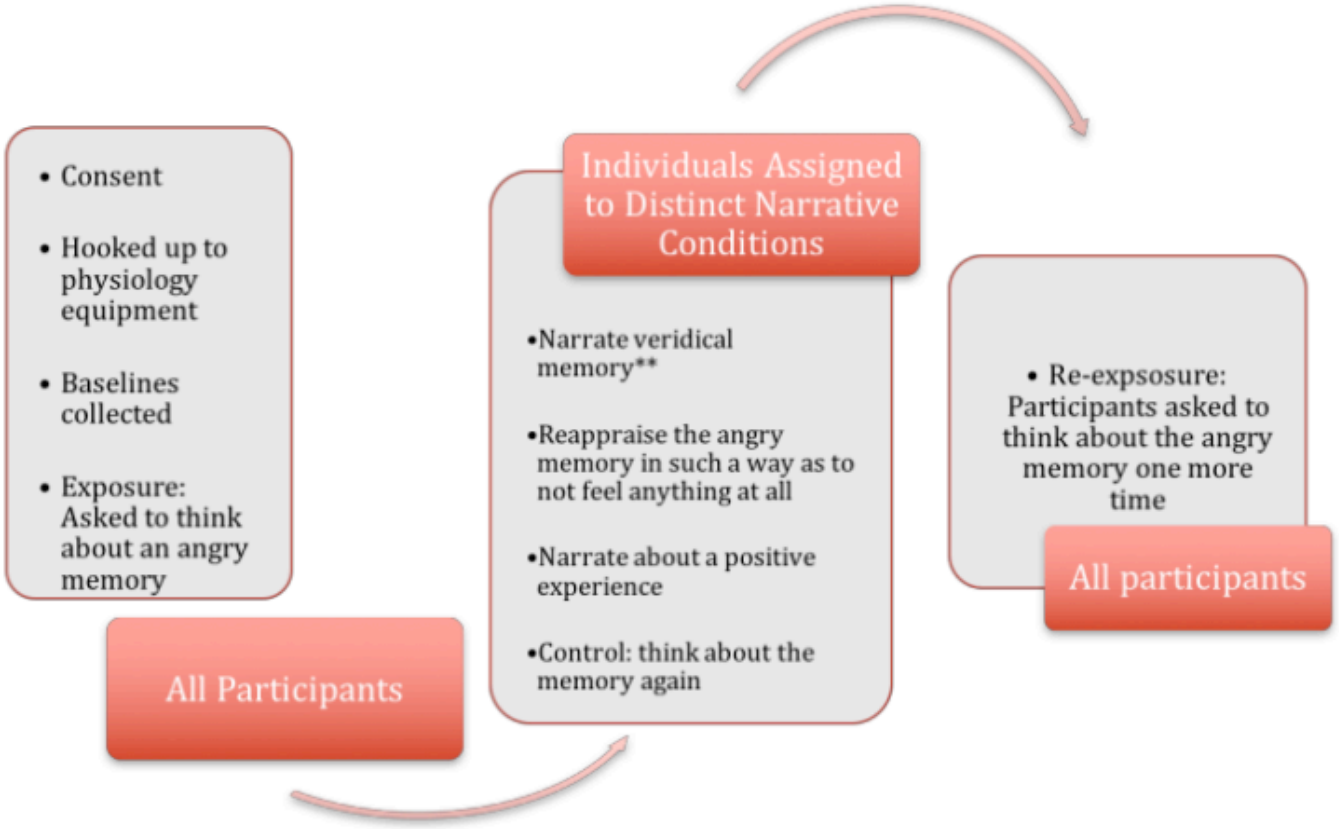

Figure 1. Study Design.
Note. Only participants in the narrate condition were used for this paper.

Table 1
Descriptive Statistics for Self-Reported Ratings of Anger and Physiological Arousal

	Whole Sample		Men		Women	
Epoch	Mean	(SD)	Mean	(SD)	Mean	(SD)
Exposure						
Self-Reported Anger	3.57	1.66	3.74	1.45	3.47	1.80
SCL	.99	1.04	.99	1.24	.99	.93
RSA	-1.22	.84	-1.17	.62	-1.25	.96
Regulation						
Self-Reported Anger	3.33	1.76	2.53	1.58	3.83	1.70
SCL	-7.22	22.96	-15.70	34.44	-1.67	6.43
RSA	-5.96	6.97	-3.81	3.56	-7.33	8.22
Reexposure						
Self-Reported Anger	3.31	1.64	3.42	1.77	3.23	1.57
SCL	1.33	1.41	1.29	1.45	1.36	1.40
RSA	-1.21	.85	-1.34	.59	-1.12	.99

Table 2
Embodied Coding System

Coding Variable	Definition	Examples
Embodied Action	Actions done with the narrator's body; Descriptions of the narrator's body that would indicate to them that they were feeling an emotion	"I cried" "I walked away" "I said" "My eyes went all red. Everything I saw had a red tint" My body felt tense and my throat felt swollen "I become disoriented"
Physical Metaphors	Phrases that describe emotional experiences as physical experiences	"We were closer than blood felt" "We weren't on the same page" My world was flipped upside down "I was upset" "He destroyed every last piece of me"

RESULTS

Overall Analytic Strategy

For all the analyses that follow I examine correlations for the whole sample and then separately for males and females. Given that traditional significance testing can be very conservative when using a small sample size such as ours ($N = 49$), and our project is exploratory in nature, we will focus below on reporting effect sizes (Tabachnik & Fidell, 2001), the advantage of which is that the reported value is independent of the sample size used to perform the significance test (Abelson, 1995). Thus, any effect sizes that meet the threshold of a moderate effect (.30) and larger will be reported (Cohen, 1988). I will refer to these effects as "noteworthy" for the purpose of this paper.

When and How Do People Use Embodied Language? Does This Vary by Gender?

There was a wide range in each of our narrative variables of interest as shown in Table 3. While women used slightly less overall embodied language than men, as shown, the observed difference was not significant, $t(47) = -.547$, $p = .58$. Additionally there were no significant differences between men and women and the use of physical metaphor $t(47) = .85$, $p = .67$. These results demonstrate that there are large individual differences in both the amount of embodied language that people use in narratives about emotional events and the type of embodied language that they use (e.g., embodied action, physical metaphor, etc.), although these differences are not associated solely with participant

gender. What do such individual differences look like at the level of the overall narrative? Below, consider examples of narratives with low and high levels of embodied language and physical metaphor. Phrases that were coded for use in the statistical analyses are underlined.

Low-embodied language:

> My friend killed himself and it made me feel really sad thinking about it. I also felt a little guilty. As any friend would-because we all think we could have prevented it. It was the worst day of my life. Every time I think about it, it makes me sad.

High-embodied language:

> The memory I had recalled was about me finding out that my ex girlfriend had been cheating on me while she was at boot camp. My friend and I had been talking, and she revealed that my ex told her that rumors about her having sex around base were true. I was angry and hurt. My eyes went red, all I could see had a red tint. It was the angriest I had ever been. I ran around, tried not to hit things or scream, because although I was extremely mad, I remained logical. Don't hit things; you'll hurt your hand. It meant a lot to me. My world was flipped upside down. I had meant to marry this girl, and the fact that she cheated on me made me very angry, very upset and insecure.

Low physical metaphor:

> It was just me and my dad at home and we got into argument round 11:00 pm over prayers and I left home and drove to Walmart crying and decided not to come back, I was very angry but like after half hour I decided to come back home and talk with them. I kind of felt guilty leaving the house, but at the same time it was also a good lesson for my dad.

High physical metaphor:

> I thought about when my ex-boyfriend recently broke up with me and called off our future he promised. I was devastated and it's still hard to process. It felt like my life was over. I felt broken and so sad. It meant change and the end of something that meant so much to me. I had to start a new life, rethink my plans and face a scary new reality that is still hard to deal with sometimes because I still love and miss my ex even though I shouldn't.

Is Arousal When Initially Recalling an Emotional Memory Associated With Embodied Language When Narrating That Memory?

Self-Reports of Anger at Exposure

Across the entire sample, no correlation between anger at exposure and embodied language met my effect size criterion. For men, self-reported anger was negatively correlated with the amount of embodied action focused language used relative to the overall amount of embodied language in the narrative, and positively correlated with the amount of physical metaphor focused language used relative to embodied language references. This means that the more anger a man reported at exposure to his memory, the less his narrative emphasized embodied action, relative to overall amount of embodied language he used. Additionally, the more anger that a man reported at exposure to his memory, the more physical metaphor his narrative emphasized relative to overall amount of embodied language he used. For women, there was a positive relationship between self-reported anger at exposure to a memory and overall embodied language use. This means that the more angry a woman reported feeling upon exposure to her memory the more embodied language she used in her narrative about that memory (see Table 4).

Physiological Arousal to Anger at Exposure

SCL and RSA Arousal at Exposure

Across the entire sample there were no noteworthy relations between SCL or RSA arousal at exposure and the use of overall embodied language or overall physical metaphor. This was also the case for men and for RSA arousal in women (see Tables 5 and 6). For women, however, the higher SCL at exposure to the angry memory, the more the narrative contained physical metaphor, relative to narrative length, and to overall

embodied language. In other words, women whose initial SCL arousal to their anger memory was higher used more physical metaphor in their narratives (see Table 5).

Does the Use of Embodied Language in a Narrative About an Emotional Memory Change Arousal to That Memory Upon Reexposure?

Postnarration Self-Reports of Anger

Self-reports of anger immediately following narration, and following reexposure to the angry memory were examined while controlling for anger at exposure; thus, the reported effects represent relations between embodied language variables and the extent to which self-reported anger was higher or lower than expected based on initial anger at exposure (see Table 4).

For the whole sample, and for both men and women, there were no noteworthy relations between embodied language and anger immediately after narrating.

For the sample as a whole there were no noteworthy associations between self-reported anger at reexposure to the memory and the embodied language measures. For men, at reexposure, self-reported anger was higher than expected when men used more overall physical metaphor. However, inspection of scatterplots revealed that this relationship was driven by one male participant who used extensive physical metaphor relative to the whole sample. For women, the more physical metaphor a woman used in her narrative about an angry memory the lower her self-reported anger after narrating. This negative relationship was also found for physical metaphor focused language (see Figure 2). This means that the more of a woman's overall embodied language use consisted of physical metaphor focused language, the less angry she reported being at reexposure to that memory, relative to her anger at exposure. As can be seen in Figure 2,

once about half of women's embodied language was physical metaphor, she reported feeling better at reexposure, than at exposure. Correspondingly, there was a positive relation between embodied action focused language and self-reported anger such that the more embodied action focused language a woman used, relative to her overall embodied language use, the higher her self-reports of anger than expected upon reexposure to that memory (see Figure 3).

Physiological Arousal Postnarration

Physiological measures of arousal at reexposure were examined while controlling for arousal levels at exposure; thus, the reported effects represent relations between embodied language measures and the extent to which SCL arousal or RSA arousal were higher or lower than expected based on initial arousal at exposure.

Across the whole sample and for men, there were no correlations between SCL arousal at reexposure, and the four embodied language measures. For women, however, there was a negative relationship between the amount of embodied action focused language used during narration and SCL arousal at reexposure such that the greater the percentage of a woman's overall embodied language use that consisted of embodied action focused language, the lower than expected, her SCL at reexposure (see Table 7). As demonstrated in Figure 4, those women where embodied action focused language comprised approximately 60% and greater of their embodied language use showed the most benefit in SCL arousal at reexposure.

For the relationship between embodied language use and RSA arousal at reexposure, again there were no reportable effect sizes across the sample as a whole or for women. For men only, there was a negative relation between the use of overall

physical metaphor and RSA arousal at reexposure indicating that the more overall physical metaphor a man used in narrating about an angry memory, the higher than expected his RSA at reexposure to that memory (see Figure 5). There was also a relation, for men only, between physical metaphor focused language and RSA arousal at re-exposure such that the greater the percentage of overall embodied language used in his narrative about an angry event that was physical metaphor focused, the higher a man's RSA upon reexposure to that memory (see Table 8), though upon inspection of scatterplots it appears that this effect was driven by a single outlier.

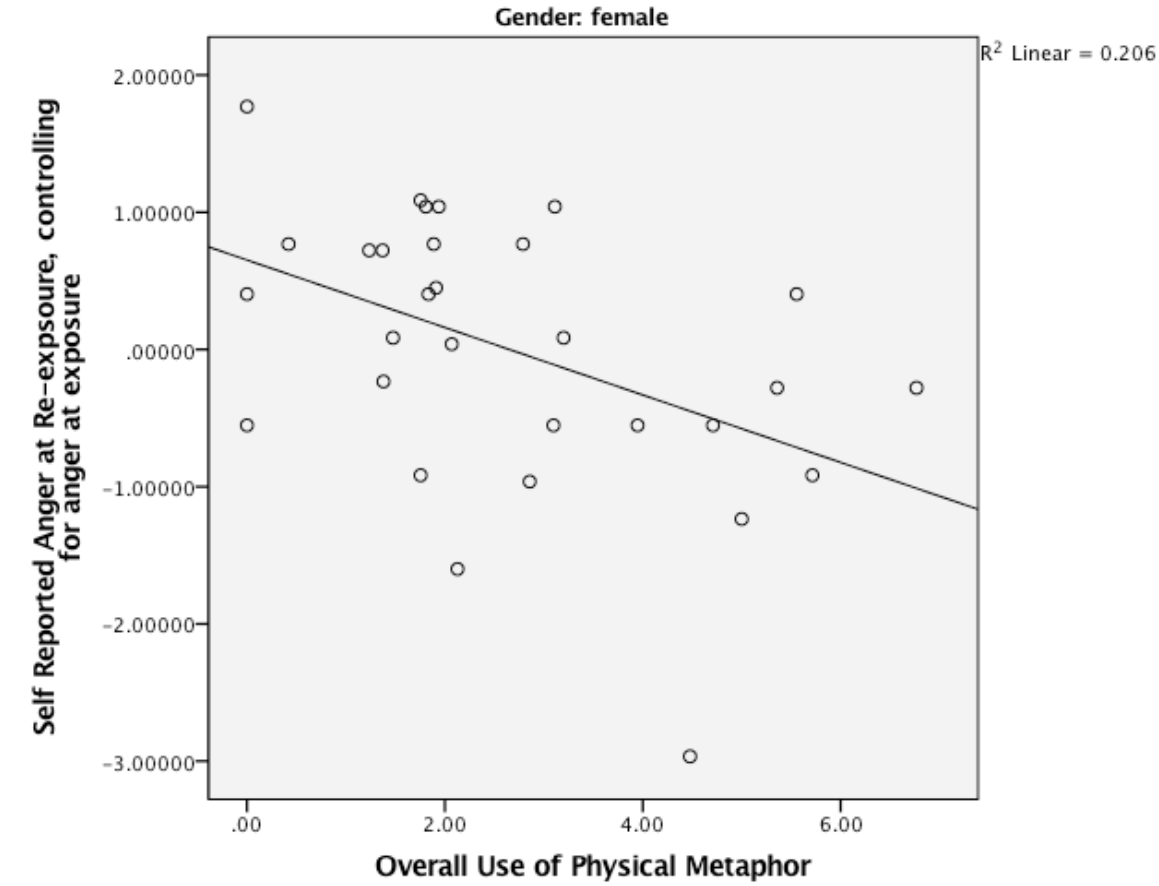

Figure 2.

Overall Use of Physical Metaphor

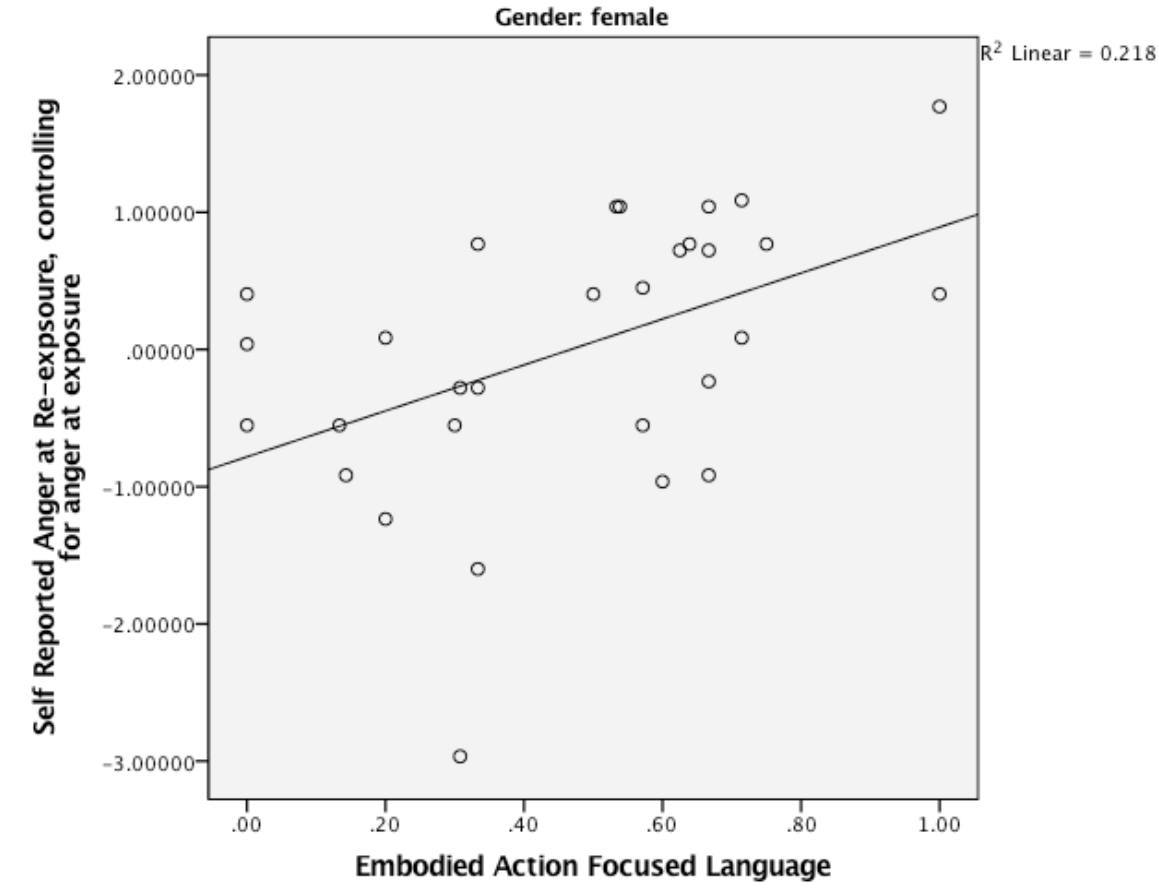

Figure 3.

Embodied Action Focused Language and Self-Reported Anger

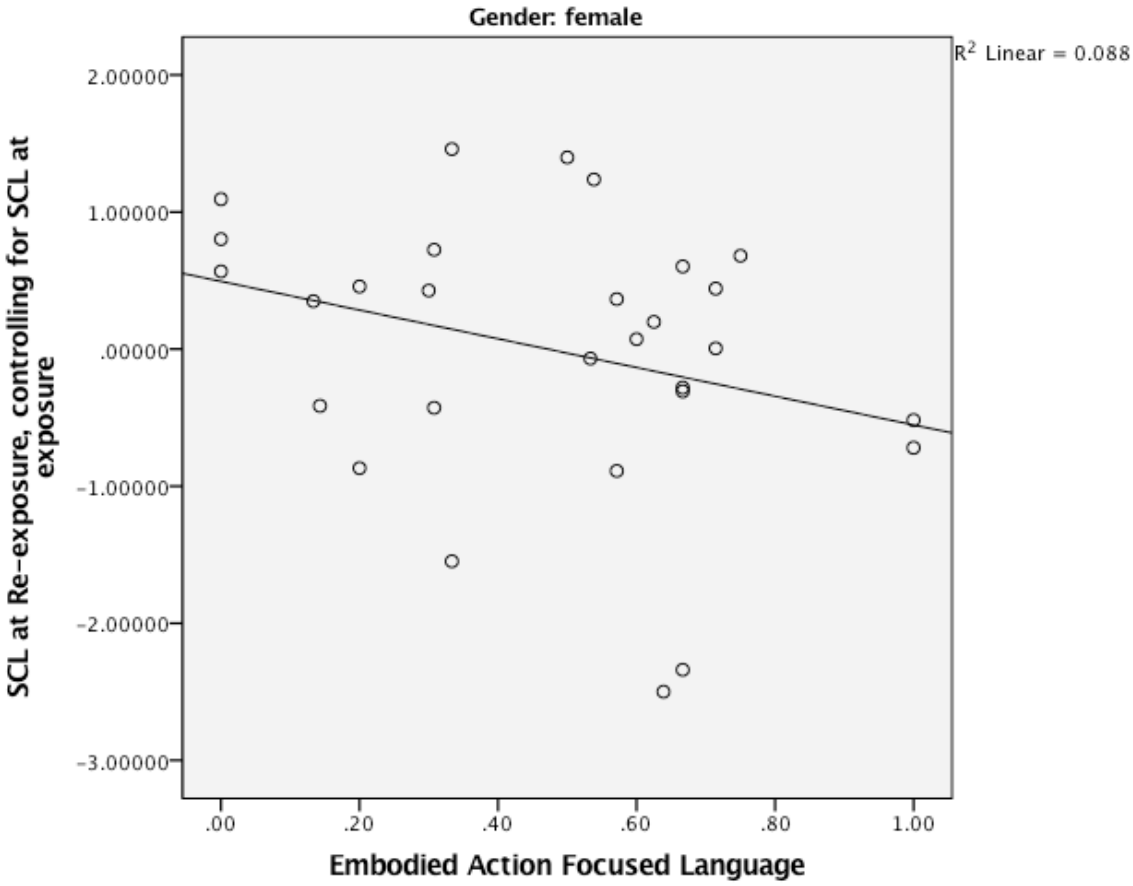

Figure 4.

Embodied Action Focused Language and SCL

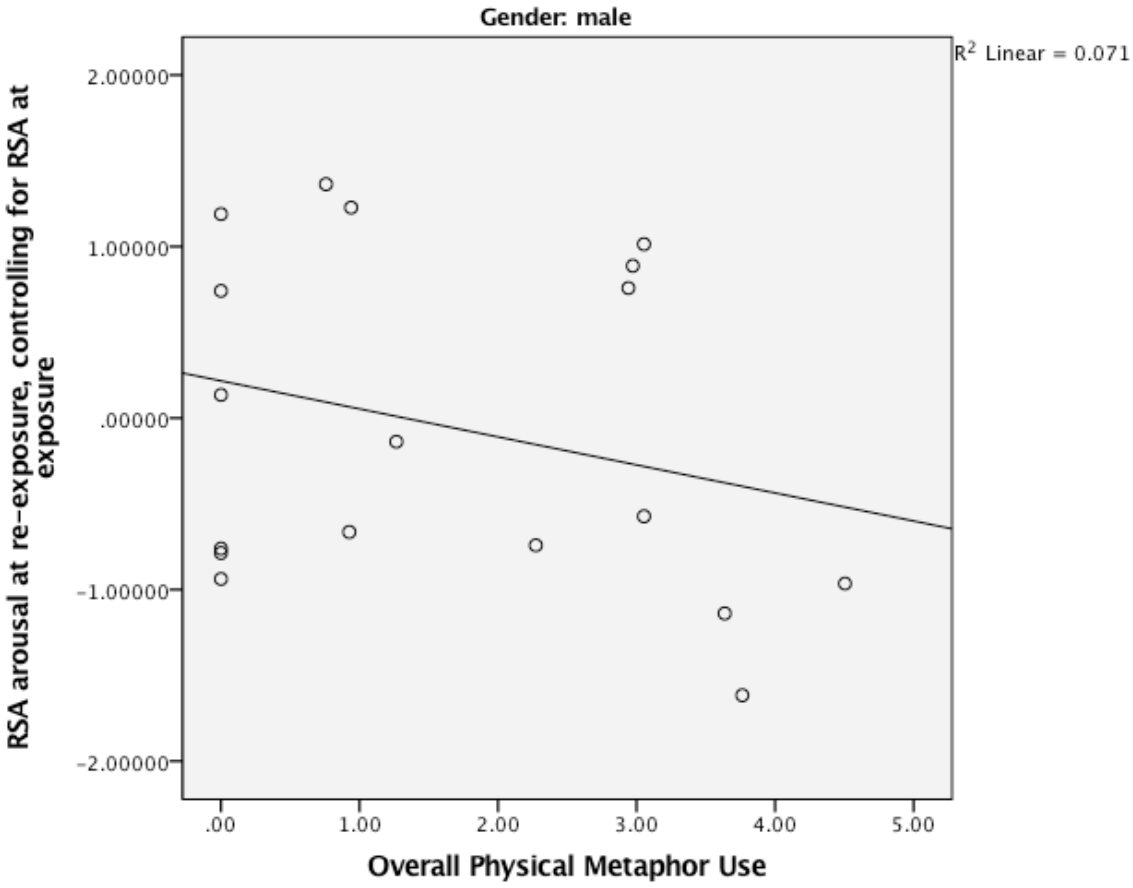

Figure 5.

Overall Physical Metaphor Use and RSA Arousal

Table 3

Descriptive Statistics of Dependent Variables and Correlations With Time Since Event

	Overall				Male ($N = 19$)				Female ($N = 30$)			
Dependent Variables	Mean	*SD*	Range	*R*	Mean	*SD*	Range	*R*	Mean	*SD*	Range	*R*
Word Count	164	94.52	36-471	-.07	150	102.85	44-471	-.14	172	89.55	36-466	.03
Coded numbers of embodied language	8.49	6.47	0-36	-.06	7.26	6.05	0-23	-.17	9.27	6.64	0-36	.08
Overall ratio of embodied language	5.13	2.60	11.03	.02	4.86	2.89	9.92	.16	5.3	2.44	11.03	.21
Overall ratio of physical metaphor	2.48	2.23	11.86	.04	2.21	2.80	11.86	-.16	2.65	1.82	6.77	-.04
Embodied action focused language	.42	1.0	7.00	-.13	.27	1.56	7.0	-.23	.467	.27	1.0	.23
Physical metaphor focused language	.58	1.0	7.00	.13	.68	1.56	7.0	.18	.466	.27	1.00	-.12

Table 4

Correlations and 95% CI's for Narrative Measures and Self-Reported Anger by Epoch

	Overall Sample			Men			Women		
	Exposure	Narration	Reexposure	Exposure	Narration	Reexposure	Exposure	Narration	Reexposure
Overall embodied language use	.19	.10	-.20	.03	-.08	-.24	.30	.16	-.16
95% CI	[-.14, .49]	[-.21, .36]	[-.43, .04]	[-.46, .62]	[-.39, .31]	[-.65, .32]	[-.09, .60]	[-.24, .52]	[-.46, .12]
Overall physical metaphor	.17	.05	.02	.28	-.22	.36	.13	.22	-.46
95% CI	[-.18, .44]	[-.26, .41]	[-.36, .26]	[-.38, .73]	[-.65, .38]	[-.09, .65]	[-.22, .41]	[-.15, .53]	[-.68. -.21]
Embodied action focus	-.21	.14	-.10	-.39	.22	-.24	.03	-.15	.47
95% CI	[-.39, .19]	[-.43, .38]	[-.27, .38]	[-.70, .31]	[-.56, .59]	[-.62, .30]	[-.33, .37]	[-.46, .19]	[.20, .68]
Physical metaphor focus	.18	-.15	.10	.34	-.25	.23	-.03	.20	-.40
95% CI	[-.32, .39]	[-.39, .41]	[-.35, .27]	[-.46, .68]	[-.59, .45]	[-.24, .61]	[-.38, .31]	[-.18, .50]	[-.66, -.13]

Note. Correlations at Narration and Reexposure are partial correlations, controlling for anger at exposure.

Table 5
Pearson's Correlations and 95% Confidence Intervals for Narrative Measures and SCL at Exposure, Standardized for Individuals

	Total Sample	Males	Females
Overall embodied language	.15	.20	.10
95% CI	[-.12, .39]	[-.12, .52]	[-.36, .47]
Overall Physical metaphor	.20	.12	.30
95% CI	[-.03, .41]	[-.28, .51]	[.03, .54]
Embodied action focused	-.04	-.01	-.25
95% CI	[-.37, .11]	[-.40, .30]	[-.60, .18]
Physical Metaphor focused	.07	.01	.41
95% CI	[-.07, .45]	[-.29, .41]	[.09, .66]

Table 6

Pearson's Correlations and 95% Confidence Intervals for Narrative Measures and RSA at Exposure, Standardized for Individuals

	Total Sample	Males	Females
Overall embodied language	-.03	-.15	.03
95% CI	[-.25, .17]	[-.48, .18]	[-.27, .33]
Overall Physical metaphor	-.06	-.13	-.03
95% CI	[-.26, .14]	[-.67, .16]	[-.29, .33]
Embodied Action Focused	.01	.01	.02
95% CI	[-.20, .13]	[-.22, .64]	[-.34, .31]
Physical Metaphor Focused	.00	-.04	.06
95% CI	[-.16, .20]	[-.63, .40]	[-.20, .39]

Table 7
Partial Correlations and 95% CI's for Narrative Measures and SCL at Reexposure, Controlling for SCL at Exposure

	Total Sample	Males	Females
Correlation with overall embodied language	-.12	-.24	-.05
95% CI	[-.40, .17]	[-.66, .27]	[-.50, .29]
Correlation overall physical metaphor	.07	.07	.07
95% CI	[-.21, .27]	[-.57, .45]	[-.22, .31]
Correlation embodied action focused language	-.18	-.25	-.31
95% CI	[-.36, -.02]	[-.52,.36]	[-.51, -.04]
Correlation physical metaphor focused language	.11	.20	.05
95% CI	[-.21, .24]	[-.50, .48]	[-.42, .45]

Table 8
Pearson's Correlations and 95% Confidence Intervals for RSA at Reexposure, Controlling for RSA at Exposure

	Total Sample	Males	Females
Correlation with overall embodied language	.15	.09	.13
95% CI	[-.08, .35]	[-.28, .46]	[-.14, .42]
Correlation with overall physical metaphor	-.11	-.38	.01
95% CI	[-.36, .24]	[-.68, .15]	[-.34, .37]
Correlation embodied action focused language	.19	.32	.00
95% CI	[-.18, .37]	[-.61, .41]	[-.36, .38]
Correlation of physical metaphor focused language	-.18	-.31	.00
95% CI	[-.37, .26]	[-.69, .16]	[-.39 .37]

DISCUSSION

The Use of Embodied Language in Narrative.

The hypotheses of this paper were informed by the idea that people's narratives about emotional experiences could reflect their physical experiences through the use of embodied language. My first goal in this study was to quantify and describe the prevalence of embodied language, defined as language that conveys subjective and psychological experience using words and phrases that are based on physical, tangible action and experience in narratives about angry events. I found that I was able to reliably identity and classify embodied language. However, the use of embodied language, while present in the large majority of narratives (96%), was not uniformly distributed across the sample (Range=0-36 coded embodied language uses) or across types of embodied language.

Self-Reported Arousal at Exposure and the Use of Embodied Language

Given the wide range in variability in both the amount and type of embodied language used, my second and third questions examined several factors that could be contributing to these differences. Specifically, I began by asking if arousal at exposure to a memory contributed to the use of embodied language. With regards to self-reported anger, for women, more intense anger at exposure was linked to more overall embodied language usage. This finding suggests that the more angry a woman is upon exposure to

a memory, the more the body is present in a woman's narrative about that memory. This is in line with our hypothesis, that increased arousal would correlate with an increase in embodied language use, and in line with current thinking within the embodied cognition literature that a bidirectional relationship exists between strength of the somatosensory simulation and subjective reports of emotion (Barsalou, 2008). In other words, a strong subjective rating experience of anger may make a person more sensitive to the physical experience of anger, and in turn, relate to emphasizing that experience in their narrative through the use of embodied language.

For men, self-reported anger at exposure was related to the use of less embodied action focused language, relative to overall embodied language use. This finding appears consistent with our second hypothesis regarding arousal and embodied language use, specifically that when aroused, some individuals may use language to direct attention away from their bodies.

Physiological Arousal at Exposure and the Use of Embodied Language

Physiological arousal at exposure, in addition to self reported arousal at exposure was also linked to greater usage of certain types of embodied language for some people. Specifically, for women, SCL arousal at exposure to a memory was linked to the higher use of overall physical metaphor and physical metaphor focused language, relative to total embodied language use. Again, this fits with our hypothesis that the more physiologically aroused an individual was at exposure to an angry memory, the more embodied language they would use during narration. However, this finding also contradicts the previous findings regarding men's increased bodily awareness. This is a

signal that relations between gender, physiology, and the use of embodied language are complex and not straightforwardly consistent with a simplistic idea about gender.

The Use of Embodied Language and Self-Reported Arousal at Reexposure

My third question involved considering the relation between the amount of embodied language used during narration and arousal upon reexposure to that memory. I hypothesized that people who used more embodied language would be less aroused at re-exposure than they were at exposure, and my data suggests that I was partially correct in this thinking. Specifically, this hypothesis was true for women. In other words, the more overall physical metaphor a woman used during narration of an angry event the less angry she was relative to expectations, at reexposure. By contrast, the more overall physical metaphor a man used during narration of an angry event, the *angrier* he was relative to expectations, at reexposure to that memory.

The Use of Embodied Language and Physiological Arousal at Reexposure

With regards to physiological arousal at reexposure and its relation to the use of embodied language, there were no noteworthy effects across the entire sample for either SCL or RSA. However, for men only, physiological arousal at reexposure, in terms of RSA, was negatively associated with the use of overall physical metaphor and physical metaphor focused language, relative to the total amount of embodied language used. Specifically, the more physical metaphor a man used in his narration of an angry event, the less RSA arousal he manifested upon reexposure to that memory. Thus, as a man's level of anger shifts, so does his RSA. This pattern of vagal withdrawal in response to

emotion is consistent with previous work documenting that RSA has been shown to accompany shifts in emotional experience (Appelhans, et al., 2006; Beauchaine, 2001; Porges, 1995; Porges et al., 2006).

For women only, SCL arousal at reexposure was negatively associated with embodied action focused language relative to overall embodied language use. In other words, the more embodied action focused language that a woman used the lower her SCL at reexposure. This finding is in line with previously mentioned work associating lower SCL arousal with disclosure (Pennebaker, 1989). Thus, the more embodied details of her memory a woman includes in her narrative, the lower her SCL at reexposure to that memory.

In sum, the type and amount of embodied language used in a narrative about an angry experience varied along with initial arousal, but not in easily predictable and patterned ways. Instead the use of embodied language and arousal appears to be inextricably linked with gender. Specifically, for men, self -reported arousal is related to more physical metaphor use during narration, and more self-reported anger at re-exposure, while for women, greater SCL arousal at exposure and greater embodied language use during narration are related to less self-reported arousal after narration.

The Importance of Gender

An important implication of these findings is that the way people represent their bodies when telling stories about previous anger experiences is linked to gender. My findings show that gender influences not only if and when a person uses embodied language, but also what type of embodied language they will use. Gender also appears to influence what the implications for using embodied language will be for later emotional

and physiological arousal.

In general, the pattern of embodied narration appears to take two distinct pathways. For women the pattern of arousal at exposure, embodied language use and arousal at reexposure shows a nice adaptive pattern with increased arousal at exposure, leading the use of more embodied language, leading to lower self-reports of anger and lower SCL responding at reexposure (see Figure 6). For men the pattern is not as adaptive. For men increased sympathetic nervous system arousal increases the amount of physical metaphor use, which, in turn, is associated with to vagal withdrawal, and increased self-reports of anger.

These distinctive patterns of narration may develop for a couple of reasons. First, beginning in early childhood, girls are exposed to more elaborated talk about negative emotions than are boys (Fivush et al., 2000), and boys, more so than girls, come to expect negative consequences for expressing emotion (Fuchs & Thelen, 1988). Thus, women may be more accustomed to using narrative to down regulate emotion than are their male peers, while men are more accustomed to using narrative to justify their emotions. Thus, as men narrate, they may be explaining to themselves and their audience why it is okay for them to be feeling the way that they are.

Another possibility has to do with our cultural and highly gendered interpretation of anger. Anger is classified in both Greek and Roman taxonomies of emotion as a positive feeling, linked to manly pride and the opportunity to avenge wrongdoing. By contrast, for women, anger is often linked to shame and a sense of being "unladylike." Thus, when given the opportunity to narrate about their angry memory, females used that chance to down regulate the emotion and constrain it into what would be considered

"socially appropriate" bounds while men used language to help align their physical arousal with their emotional arousal, thus maintaining high levels of arousal, both self-reported and physiological, at reexposure.

Physical Metaphor Is a Distinct Type of Embodied Language

Another interesting finding to come out of this study is that physical metaphor is a distinct and important subtype of embodied language, behaving differently in most of our analyses than embodied action language. This may be because embodied action language is a direct, less cognitively taxing way of reporting experience, while the use of physical metaphor is a unique form of meaning making. In other words, embodied action is a report of veridical information about the actions of the body in the past. By contrast, I believe that as people describe their physical experiences using metaphor, they imbue it with judgment, assign it value, and make meaning of it. Thus, while embodied action language is a summary report of what happened, the use of physical metaphor is a unique way of making sense and meaning of the event being narrated.

Limitations and Future Directions

In terms of limitations, our greatest was that of sample size and power. Specifically, our sample was too small for correlational work. Thus, given that the phenomena I observed all varied by gender, in order to fully detect and explore these relationships, I would need a much larger sample size.

Future research in this area should be devoted to better understanding physical metaphor as a distinct type of embodied language and a unique form of meaning making necessitating its own line of thought and research that integrates the fields of embodied

cognition and narrative. Additionally, future research should investigate the interplay between gender and the use of embodied language. Specifically, given the gender differences found in our study, it appears that further study of embodied narrative could contribute greatly to our understanding of how the meaning making process unfolds differently for men and women.

From the embodied cognition perspective all our meaning, thought and language emerge from the experience of embodied activity (Johnson, 2007). Thus, our attempts at rational understanding and meaning making may be best served, not by attempts to escape or ignore our bodily experience, but rather by embracing it and using it to further our understanding of ourselves. Given that a large majority of people uses embodied language when narrating about a previous emotional experience, we submit that our physical experience is an integral, yet heretofore understudied part of narrative research. To quote Gabrielle Roth, "Your body is the metaphor of your life…It is your Bible, your encyclopedia, your life story." Read on.

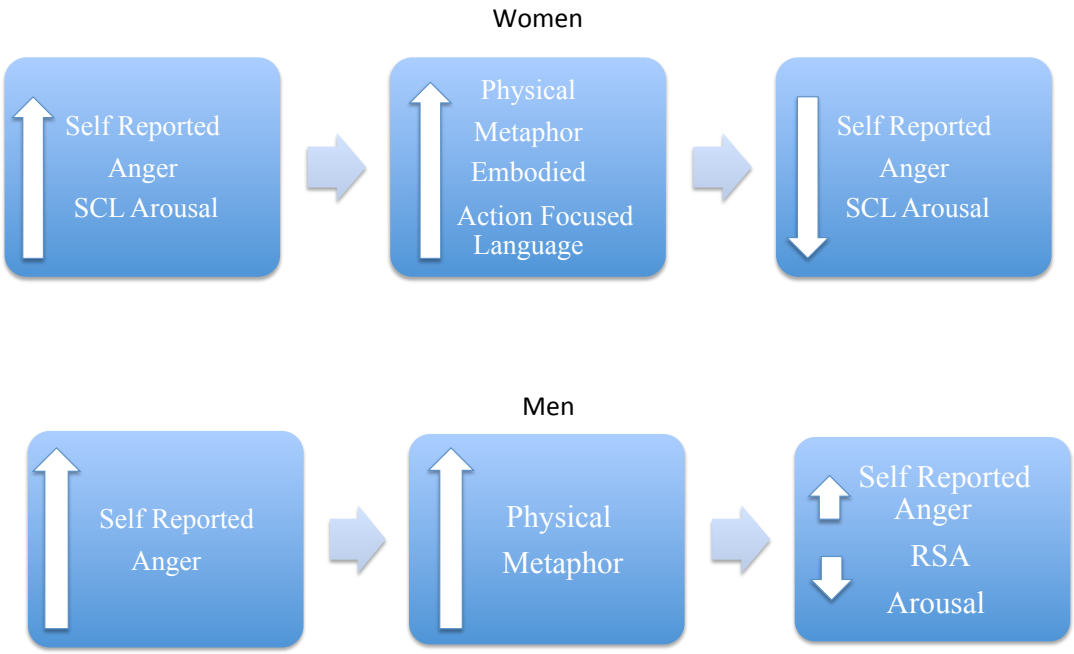

Figure 6. Patterns of Arousal and the Use of Embodied Language.

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